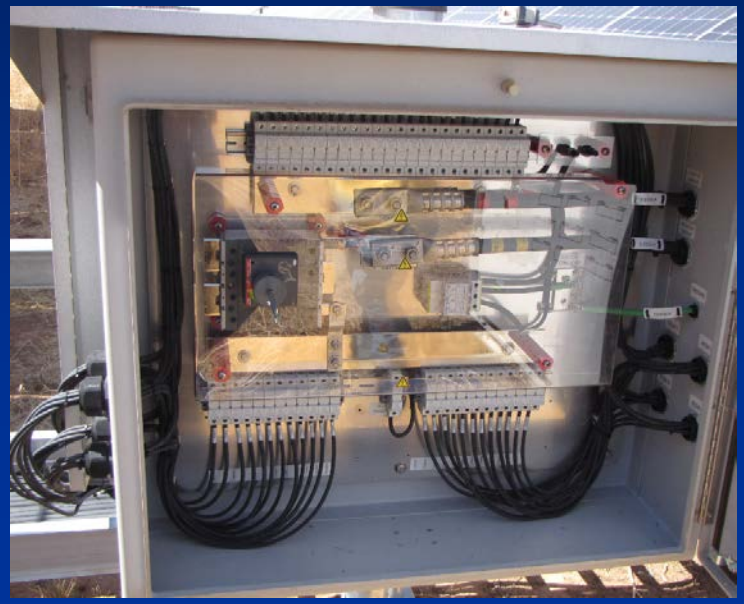
ELECTRICAL SAFETY
On
Solar Farms



IMPORTANT USER NOTE: This document was created in 2014 by the DoD Electrical Safety Working Group (ESWG) and is based on Codes and Standards in force in 2014. To use this document properly, the user must refer to the code in force at the date of use.

Appendix E-1 – Electrical Safety in Design Final Report
Electrical Safety on Solar Farms
July 2014

Shock Hazards

- *The AC-side shock hazards are the same as any other AC application…*
- *The DC-side presents significant shock hazards on the Grounding and Bonding system*
- *Certain types of faults may not be sensed and can energize the metal support structures*
- *Ground Fault protection helps but is not 100% effective…*

Arc Flash/Arc Blast Hazards

- ***The AC-side has Significant Arc Flash hazards!***
  - ***Use of secondary-side circuit breakers is recommended***
- ***The DC-side has very low Arc BLAST hazards. In this case, workers really can move away from the arc…***
- ***The DC-side has very low Short Circuit Current & arcs can burn for MINUTES…***
- ***HOWEVER…***

Severe arc-blasts on AC-Side

Virtually no arc-blast on DC-Side

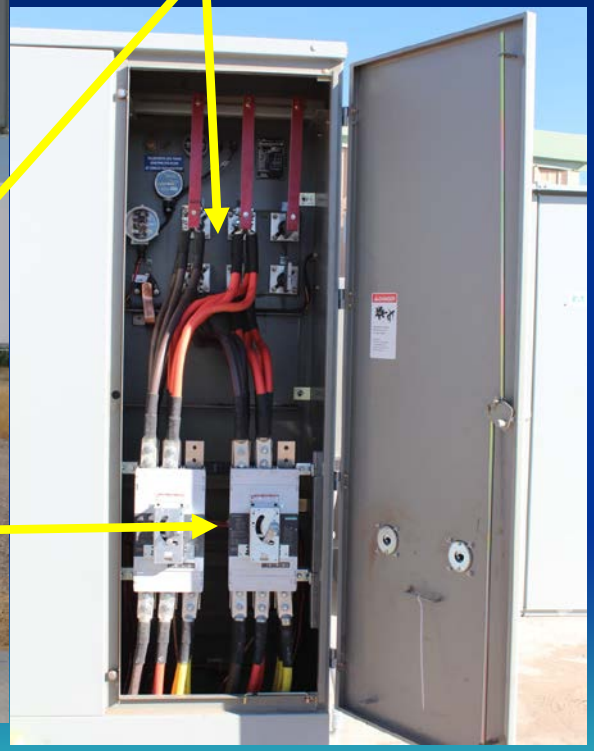
The DC Faults Just Keep On Going…

Padmounted Transformers

34,500 volts

XFMR Fuses

Two circuits of 342 volts



LV Circuit Breakers

Lightning Arrestors

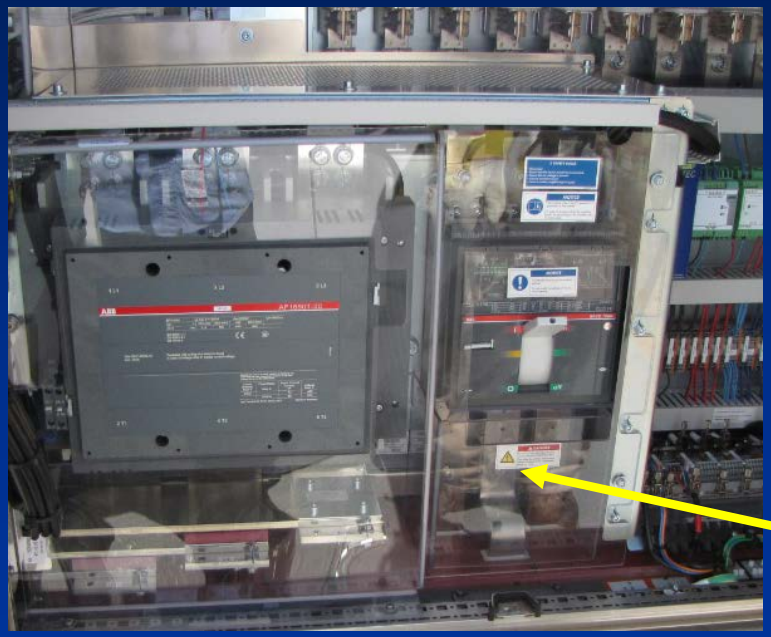
Secondary-sideCircuit Breakers Make a Difference!

515 cal/cm^2

3.8 cal/cm^2

Configuration	Arcing Current (KA)	Clearing Time (sec)	IE (cal/cm^2)
No Secondary-side Breaker	17.35 (100%)	7.2	**514.9**
No Secondary-side Breaker	14.75 (85%)	12.5	**890**
No Secondary-side Breaker	17.35	2	**114.4**
WITH Secondary-side Breaker	17.5	0.05	**3.8**

Without Secondary-side Breakers…



You have here too…

Whatever you have here…

Recommendations

- ***Wear proper PPE <u>100% of the time</u> when troubleshooting faults on the PV arrays!***
- ***Test before you touch!***
- ***Use Secondary-side circuit breakers in transformers***
- ***Use Ground Fault sensing systems***
- ***Take advantage of the "scheduled outage" you get every night…***
- ***We'll talk more about this at another time…***